WATER UTILITY

AFFECTED ENVIRONMENT

Supply and Demand

Seattle Public Utilities (SPU) manages the water system that serves Seattle and numerous suburban cities. Approximately 1.3 million residents are served in this area, including 595,000 direct customers (through 175,000 metered connections) and nearly 687,000 customers served by water districts and cities that are wholesale purchasers. The system's water supply sources are the Cedar River and Tolt River watersheds, and the Highline well field. SPU does not anticipate needing any additional water rights in order to meet system demands over the next 20 years. SPU is negotiating an agreement to participate in a "Second Supply Project" that should help further assure long-term supply availability and reliability.

SPU correctly predicted that per capita water demands would decline during the 1990s due to programmatic changes, conservation, plumbing code changes and rate increases. Since a 1992 drought, growth in water demand from suburban purveyors has been less than predicted, and total water demand in Seattle actually decreased during that period. Average daily water demand is projected by SPU to decline slightly through 2010, from 149 million gallons per day (mgd) in 1999 to 144 mgd in 2010. Conservation efforts were effective in spring/summer 2001 as the region dealt with limitations brought about by low snowfall conditions in winter 2000/2001.

Infrastructure

In Downtown, a majority of water mains are more than 50 years old. Portions of the system have been upgraded over time concurrent with road improvements. The older pipes are predominantly cast iron, and upgraded sections are ductile iron. Pipes range in size from 6 to 30 inches in diameter. Planned system improvements in central Seattle include replacement of the Lincoln Reservoir with a new below-ground reservoir, and major improvements at the Beacon reservoir as well. In general, SPU considers the system to have adequate capacity to meet existing demands. SPU is engaged in a long-term planning effort to comprehensively analyze the system and prioritize future improvements, taking into consideration factors such as need for seismic protection.

Water Pressure

Within Seattle, the reservoirs and distribution system provide gravity flow in most areas. The Commercial Core, Denny Triangle and Belltown areas are all within the 326 pressure zone; storage for water serving these areas is provided at the Lincoln reservoir on Capitol Hill and the Beacon reservoir on Beacon Hill. Water pressure ranges from adequate to very good (see Table 62).

Table 62
Existing Water Pressure Ranges in Downtown Seattle

Area	Pressure Range	Pressure Quality
Commercial Core	40 to 135 psi	Adequate
Denny Triangle	68 to 113 psi	Very good
Denny Regrade	68 to 135 psi	Very good

Note: 30 psi is the standard minimum working pressure for new construction.

Fire Flow Capability

Fire flow capability relates to the volume of water available to fight fires, typically accessed by hydrants. Fire flow needs for structures relate to the age, type of construction, size and presence of fire-protective features such as sprinkler systems. Due to the superior fire protection provided by sprinkler systems, a sprinkler-equipped building requires roughly half as much fire flow capability at nearby hydrants as an older building without sprinklers.

The network of water mains in the study area has segments varying considerably in age, size and condition. Cement-lined pipes less than 60 years old are typically in excellent internal condition, but older cast iron pipes can have reduced flow capabilities due to corrosion problems.

In order to characterize the capabilities of the system in the study area, SPU used a calibrated hydraulic model (EPANET) to evaluate fire flow capacities. This model had been recently revised and updated, and available field test data and other technical data were used to help verify model results. Per recommendations of the Fire Department, the worst-case, conservative fire flow criteria are 4,000 gallons per minute (gpm) for a sprinklered building and 8,000 gpm for an unsprinklered building. For individual hydrants, availability of 2,000 gpm at residual pressure of 20 psi is the threshold to meet those worst-case criteria.

Within the study area, the analysis identified two locations in the study area with relatively minor deficiencies in hydrant capacity: 1) Boren Avenue between Stewart and Virginia Streets; and 2) the Olive Way/Boren Avenue vicinity. At the first of these locations, the hydrant near Boren Avenue/Virginia Street has approximately 1,200 gpm of fire flow capacity rather than the desired 2,000 gpm, and the water line is only 6 inches in diameter. At Olive Way/Boren Avenue, the two hydrants together have fire flow capacity of approximately 2,500 gpm rather than the desired 4,000 gpm. In both cases the 80 to 100-year age of the pipes may contribute to capacity limitations. Project-specific review by Fire Department and SPU staff helps determine fire flow sufficiency, and allows the City to require system improvements if necessary.

IMPACTS

Alternative 1 – High End Height and Density Increase

SUPPLY, DEMAND AND INFRASTRUCTURE

This analysis addresses water use impacts for full buildout conditions and for 20 years of growth. While both are long-term analyses, the full-buildout analysis illustrates the maximum potential impacts over time and the variations among the alternatives.

Buildout Water Use

With zone changes proposed for Alternative 1, full buildout of the affected zones would generate up to approximately 24-25 percent more water demand in the study area than full buildout under the No Action Alternative.[1] This would be equivalent to an additional 1.2 to 1.4 million gallons per day if full buildout

[1] Quantitative estimates are used for daily water use per residence (80 gallons/dwelling unit), per office employee (30 gallons/employee) and per hotel room (80 to 130 gallons/room). The buildout that could occur under Alternative 4 (the No Action Alternative) is defined as the baseline condition.

was achieved. Table 63 illustrates the maximum potential water demands generated by full buildout of the alternatives in this EIS. Office and hotel development would be primarily responsible for the additional demands of Alternative 1. This maximum additional water demand of Alternative 1 at buildout is the greatest among the alternatives but would represent less than one percent of the current citywide daily water demand. Potentially occurring more than 20 years in the future, it would not represent a significant adverse impact on the City's water system infrastructure due to its relatively limited magnitude. If location-specific infrastructure problems are identified in the future, development review for individual projects would afford opportunities to require specific improvements.

Table 63
Comparison of Maximum Additional Water Demands from Full Buildout of Alternatives

	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Maximum additional water demand at buildout (gal/day)	6.3 - 7.1 million gallons	5.7 - 6.4 million gallons	5.4 - 6.0 million gallons	5.1 - 5.7 million gallons
Difference from existing zoning buildout (gal/day)	1.2 - 1.4 million gallons	650,000 - 750,000 gallons	300,000 - 350,000 gallons	0 gallons
Percent change from existing zoning buildout (%)	24 - 25%	12 - 13%	6%	0%

Source: SPO, 2002

Twenty-Year Growth in Water Use

Over twenty years, predicted amounts of total development are very similar among the alternatives, so predicted new water demands are in the range of 2.9 to 3.1 million gallons per day. Additional water demands from Alternative 1 would likely fall in the upper portion of this range, only about 1 to 2 percent (40,000 - 60,000 gallons per day) more than additional demands from the No Action Alternative. Alternative 1's additional water demand would not represent a significant adverse impact on the City's water system infrastructure due to its relatively limited magnitude.

Location of Water Meters

The location of water meters in future development is an infrastructure-related concern noted by SPU staff, for all alternatives. Water meters are commonly located in subsurface chambers within public rights-of-way, which can hinder accessibility to the meters for maintenance and require expensive work to cut open streets and sidewalks. To increase accessibility and lessen or avoid construction/maintenance impacts within public rights-of-way, the City could require water meters to be located within buildings. This would also contribute to more effective and maintainable metering of water use, to the City's benefit.

Fire Flow Capability

With zone changes proposed for Alternative 1, the potential for taller, denser buildings throughout the study area would not significantly affect the ability of the water system to provide adequate fire flows. Future development over time would increase the total number of buildings protected by the fire flow capabilities of the system.

In the locations with existing deficiencies (in comparison to worst-case fire flow criteria), project-specific review of future development proposals would allow identification of system improvements to meet fire flow requirements. Potential future improvements might be to increase the size of water lines, through City and/or project-related funding. The existing 6-inch water line along Boren Avenue between Howell Street and Denny Way is the segment most likely to be considered for replacement.

Alternative 2 – Concentrated Office Core

SUPPLY, DEMAND AND INFRASTRUCTURE

Buildout Water Use

With zone changes proposed for Alternative 2, the full buildout of the affected zones would generate approximately 12-13% more water demand in the study area than full buildout under the No Action Alternative (refer to Table 63). This would be equivalent to an additional 650,000 to 750,000 gallons per day if full buildout was achieved. Office and hotel development would be primarily responsible for the additional demands. This maximum additional water demand at buildout is approximately half as much as generated by Alternative 1, and would represent about 0.5% of the current citywide daily water demand.

Twenty-Year Growth Water Use

Additional water demand generated by Alternative 2 would be essentially the same as generated by the No Action Alternative (2.9 to 3.1 million gallons per day), and therefore no adverse impacts are identified.

Fire Flow Capability

Similar to Alternative 1, fire flow impacts of Alternative 2 would not be significant. The vicinity of Boren Avenue between Stewart and Virginia Streets with an existing fire flow deficiency would not be subject to rezone in Alternative 2.

Alternative 3 – Residential Emphasis

SUPPLY, DEMAND AND INFRASTRUCTURE

Buildout Water Use

With zone changes proposed for Alternative 3, the full buildout of the affected zones would generate approximately 6% more water demand in the study area than full buildout under the No Action Alternative (refer to Table 63). This would be equivalent to an additional 300,000 to 350,000 gallons per day if full buildout was achieved. Office, hotel and additional residential development would be responsible for the additional demands. This maximum additional water demand at buildout is approximately one-quarter as much as generated by Alternative 1, and would represent about 0.25% of the current citywide daily water demand.

Twenty-Year Growth Water Use

Additional water demand generated by Alternative 3 would be essentially the same as generated by the No Action Alternative (2.9 to 3.1 million gallons per day), and therefore no adverse impacts are identified.

Fire Flow Capability

Potential fire flow impacts of Alternative 3 would not be significant, and could be less than under Alternatives 1, 2 or 4. The vicinity of Boren Avenue between Stewart and Virginia Streets with an existing fire flow deficiency would be rezoned with lower densities and a greater emphasis on residential development, which could make fire flow needs less than expected under current zoning. Zoning in the

Olive Way/Boren Avenue vicinity with an existing deficiency would change in a way with only minor implications for building bulk and fire flow needs.

Alternative 4 – No Action

The No Action Alternative would not result in adverse impacts on the water system. Future development under the existing Land Use Code would be accommodated by the existing system. Past studies, such as analyses for the 1994 Comprehensive Plan EIS, indicated that the system would be able to handle the anticipated growth. This analysis reaches the same conclusion, even for a larger amount of growth than previously studied.

SUPPLY, DEMAND AND INFRASTRUCTURE

Buildout Water Use

No zone changes are proposed for Alternative 4, so no adverse impacts would occur. As shown on Table 63, the future buildout of existing zoning would generate approximately 5.1 to 5.7 million gallons per day of additional water demand in the study area. No adverse impacts related to infrastructure are identified.

Twenty-Year Growth Water Use

The No Action Alternative would generate additional water demand of approximately 2.9 to 3.1 million gallons per day with 20 years of growth. No adverse impacts are identified.

Fire Flow Capability

Alternative 4 would result in no adverse impacts related to fire flow. However, existing deficiencies in two locations of the Denny Triangle may need to be addressed over the long term to serve future development.

MITIGATION STRATEGIES

Although no significant adverse supply/demand impacts on the water system are expected, a strategy could be implemented to address an identified shortcoming of the water system infrastructure.

Possible Mitigation Strategies

Require water meters in accessible on-site locations

Implement code changes to require future development to locate water meters in on-site spaces, to improve accessibility and avoid needless utility maintenance work within public rights-of-way. This would also contribute to better metering of water use and greater cost-effectiveness in the City's utility operations.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

None identified.

SEWER AND STORMWATER UTILITIES

AFFECTED ENVIRONMENT

Sewage/Stormwater Drainage Collection Systems

Seattle Public Utilities (SPU) manages drainage, surface runoff and sewer systems in the City, with overall goals of maintaining public safety, water quality and resource protection. Seattle has three types of drainage and wastewater systems: combined sanitary/stormwater sewers, partially separated sanitary/ stormwater sewers, and fully separated sanitary and stormwater sewer systems. Combined sewers that handle both surface stormwater drainage and sewage volumes serve most of the Commercial Core and Denny Triangle neighborhoods.

The system consists of concrete pipes ranging from a minimum of 8 inches in diameter, to a maximum of approximately 144 inches in diameter, typically located within rights-of-way. Portions of the 1st Avenue, Western Avenue, and 3rd Avenue vicinities are served by partially separated systems that have stormdrains separating the stormwater runoff from the sewage volumes. The system routes Commercial Core wastewater flows toward King County Metro lines under 2nd Avenue, and Denny Triangle flows northward to Republican Street and then westward. Metro King County's system then conveys flows to the West Point Treatment Plant via Interbay.

Current drainage codes require new development to limit the peak volumes of stormwater runoff to a rate similar to runoff from an undeveloped site. In contrast, long-established land uses such as older paved parking lots contribute to rapid stormwater runoff because they are impervious surfaces that typically do not have detention capabilities or allow for infiltration into soils. Given the more stringent requirements imposed with new construction, new development Downtown will aid in controlling peak stormwater flows generated by a typical site.

The City's Capital Improvement Program included sewer rehabilitation projects at 1st/Union/Pike in 1997, Western Avenue/Bell Street in 1998, and Pike Street in 2000-2001. Other than incidental repair, replacement or relining of pipes, no wastewater system improvements are anticipated for the study area (SPU, 2001).

Treatment Facilities

The City's collection system delivers wastewater from Downtown to larger interceptor lines operated by King County that convey it to the West Point Treatment Plant. King County's regional wastewater treatment system serves approximately 1.3 million people. The West Point plant, located near Discovery Park, provides primary and secondary treatment of wastewater flows, and is designed for a maximum monthly average flow of 215 million gallons per day (mgd) and instantaneous maximum capacity for 440 mgd. The plant's annual flows are equivalent to an average of 191 mgd. Two other treatment plants at Alki and Carkeek Park are used only for wet weather flows.

Combined Sewer Overflow (CSO) Planning

In some areas, the capacity of the wastewater system is limited when larger peak stormwater flows enter the combined systems. When runoff volumes are large due to intense rainfall, there may be "combined sewer overflows" (CSOs) into area waters in several locations. CSOs occur in both the regional and City

systems. Seattle adopted a CSO Control Plan in 1988 to address specific improvements to control CSOs. SPU has already completed improvements (primarily increased storage and overflow monitors) to approximately 80-90 percent of the CSO locations, including outfalls to Portage Bay, Elliott Bay, the Duwamish River, Lake Union and the Ship Canal. Joint efforts with King County are still ongoing at Lake Union and the Ship Canal.

The City is updating the 1988 CSO Control Plan to direct further improvements in areas near Ballard, Magnolia, Delridge, Duwamish, Rainier, Seward Park, Wallingford, and Laurelhurst. Areas in or near Downtown are identified on a recent CSO-related map as improved basins that will be monitored.

IMPACTS

No significant adverse impacts on sewer/stormdrain capacity are anticipated. Future development under any of the alternatives would result in two different types of impacts on stormwater and sanitary sewage volumes:

Increased volumes of sanitary sewage from new commercial and residential development; and

Reduced size of peak stormwater flows during storms through installation of required improvements at redeveloped sites. The Drainage Control Ordinance requires on-site detention of stormwater (such as roof runoff), typically in vaults with flow control devices.

With greatly improved drainage controls on redeveloped sites, stormwater would be held on properties for longer periods of time and released in a more controlled manner to the system, thereby moderating peak flows.

Alternative 1 – High End Height and Density Increase

With Alternative 1, future development could occur in a denser manner and generate more sanitary sewage volumes in some areas than under current zoning. Infill development on a limited number of properties would occur in the Commercial Core and edge of Belltown, but the Denny Triangle vicinity would accommodate the greatest amount of future development.

The most common site conditions within the Denny Triangle are either large paved areas or older buildings. Both conditions include large amounts of impervious surfaces and minimal drainage controls, which promote rapid runoff of stormwater during rainstorms. Total rainfall volume for a 2-year/1-hour storm (a one-hour storm of a size likely to occur only once every two years) within the Denny Triangle is approximately equivalent to 20,200 gallons per minute (gpm). Most of this volume drains quickly from impervious surfaces to the combined sewer system.

With future development, the installation of required stormwater control facilities would slow down runoff such that the peak flows leaving redeveloped sites and entering the drainage system would be less than existing conditions. As more redevelopment occurs in the Denny Triangle over time, progressively better control of stormwater means the drainage system would be less likely to exceed capacity from surges of stormwater rapidly draining from impervious surfaces.

Compared to stormwater, sanitary sewage volumes use a much smaller fraction of system capacity. The estimated peak sanitary sewage flow with future development in the Denny Triangle by 2020 is approximately 3,750 gpm. This is much less than the estimated 2-year storm's flow of 20,200 gpm.

It is possible that the improved control of peak stormwater flows with redevelopment would more than offset the additional sewage volumes generated by new development. This suggests that adverse impacts

on combined sewer systems would be avoided, and that net impacts would be positive. However, the EIS analysis did not identify enough conclusive information to prove this hypothesis.

This EIS identifies no sewer/drainage system capacity problems in specific locations within the study area. SPU staff reviewed the Denny Triangle sewer/drainage system and found it will have sufficient capacity for the level of development that could occur with these zoning changes. If specific localized problems are identified in the future, development review for individual projects would afford opportunities to require site-specific improvements.

The maximum additional sewage that could be generated due to Alternative 1 would not represent a significant adverse impact on sewage treatment facilities. If all of the additional predicted daily water use from buildout of Alternative 1 was assumed to become sewage (1.2-1.4 million gallons), this would represent only approximately 0.75% of the annual average daily flow at the West Point treatment facility.

Alternative 2 – Concentrated Office Core

The storm drainage and sewage volume impacts of Alternative 2 on the sewer/drainage system would be similar to those of Alternative 1. The estimated peak sewage volumes generated by future development in the Denny Triangle vicinity by 2020 would be approximately 3,822 gpm, or 1.5% greater than for Alternative 1, due to a greater concentration of residential uses. However, similar to Alternative 1, no significant adverse impacts on system capacity are identified.

The maximum additional sewage that could be generated due to Alternative 2 would not represent a significant adverse impact on sewage treatment facilities. If all of the additional predicted daily water use from buildout of Alternative 2 was assumed to become wastewater (650,000-750,000 gallons), this would represent less than 0.5% of the annual average of daily flows at the West Point treatment facility.

Alternative 3 – Residential Emphasis

The storm drainage and sewage volume impacts of Alternative 3 on the sewer/drainage system would be similar to those of Alternative 1. The estimated peak sewage volumes generated by future development in the Denny Triangle vicinity by 2020 would be approximately 3,805 gpm, or about 1.5% greater than for Alternative 1, due to a greater concentration of residential uses. However, similar to Alternative 1, no significant adverse impacts on system capacity are identified.

The maximum additional sewage that could be generated due to Alternative 3 would not represent a significant adverse impact on sewage treatment facilities. If all of the additional predicted daily water use from buildout of Alternative 3 was assumed to become wastewater (300,000-350,000 gallons), this would represent less than 0.2% of the annual average of daily flows at the West Point treatment facility.

Alternative 4 – No Action

The No Action Alternative would generate no significant adverse impacts on sewers and stormdrains. Future development under the existing Land Use Code could be accommodated by the existing system. Required stormwater control facilities with new development would provide better control of peak stormwater flows than existing conditions. Past studies, such as analyses for the 1994 Comprehensive Plan EIS, indicated that the system would be able to handle the anticipated growth. This EIS supports those conclusions, even for a larger amount of growth than previously studied.

The impacts of Alternative 4 on the sewer/drainage system would be slightly less than those of Alternative 1. The estimated peak sewage volumes generated by future development in the Denny Triangle vicinity by 2020 would be approximately 3,616 gpm, or about 3.6% less than for Alternative 1.

MITIGATION STRATEGIES

No mitigation measures are required because this analysis does not identify any significant adverse impacts on the sewer/drainage system.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

None identified.